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ABSTRACT

This study was made to assess the relative effects of individual learner characteristics on the prediction of academic success in a traditional course and an independent study course in science, and to predict achievement for individual students. Variables from personality and intellective areas were employed in conjunction with biographical data. The independent study course, the Audio-Tutorial System, consists of independently scheduled, but structured, laboratory and learning sessions, audio tape tutorial presentations, an emphasis on personal student-instructor contact, and periodic oral and written quizzes, all conducted within the large class setting. A sample of 315 students were enrolled in this course, while 315 were enrolled in the traditionally organized course. Results indicated that for the high achievement subgroup, mathematics reasoning skills and science achievement were significantly related to success in the audio-tutorial course. In the traditional course, verbal aptitude, mathematical computation skills, and restraint were significantly related to success. Variables were identified which may facilitate the prediction of individual success in specific situations, the placement of students in alternative learning systems, and the provision of remedial counseling and instruction. Further research is suggested. (PR)

THE RELATIONSHIP OF INTELLECTIVE, PERSONALITY, AND
BIOGRAPHICAL VARIABLES TO SUCCESS IN AN INDEPENDENT
STUDY SCIENCE COURSE AT THE COLLEGE LEVEL¹

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OBJECTIVES

The objectives of this study were: (1) to assess the relative contri-
butions of selected individual learner characteristics to the prediction of
academic success in a structured independent study learning system within a
group setting and a traditionally-organized learning system; and (2) to
predict achievement for individual students in the two instructional systems.

RATIONALE

A learning program which attempts to implement a program of individualized
instruction must be adjustable to a wide range of individual differences (IDs)
which are related to student achievement. A major problem associated with
constructing a program for individualized learning is lack of empirical know-
ledge about the relation of IDs to various criteria of learning (e.g., academic
success in terms of grades, test performance, etc.).

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The focus of this research was the empirical study of selected learner characteristics and their relation to academic success in a structured independent study learning program. This program represents a unique approach to the individualization of instruction in science at the undergraduate level and is called the Audio-Tutorial (A-T) System. It features independently scheduled but structured laboratory and learning sessions, audio-tape tutorial presentations, emphasis upon personal student-instructor contact, and periodic oral and written quizzes. Developed by Postlethwait, Novak, and Murray (1969), the Audio-Tutorial System emphasizes structured independent study within a large class setting.

A battery of intellectual learner characteristics (i.e., those characteristics which represent observable products of cognitive processes) and personality characteristics were utilized in this study. They were selected on the basis of theoretical relevance to the learning criteria and the instructional setting. It seems likely that personality characteristics would assume a more important role in relation to student performance and achievement in an independent study course than in traditionally-organized courses. In order to facilitate such a comparison, a control group comprised of students enrolled in a traditionally-organized science course was employed.

METHOD

College freshmen and sophomores (N=630; 315 validation, 315 cross-validation) who voluntarily completed the necessary data forms and were enrolled in a one-semester, introductory, biological science course taught in the independent study mode (A-T) at a large midwestern university comprised the treatment sample in this study. A subset of this sample (N=312) also completed, subsequent to the A-T course, a one semester introductory biological science laboratory course taught in a more traditionally-organized (T-O) learning system. This group was used as a comparison sample with the criterion of final grade in the course. The treatment sample is hereafter designated as A-T; the comparison sample is designated as T-O.

The variables used were: (1) from the personality area, scores on the Guilford-Zimmerman Temperament Survey; and, (2) from the intellectual area, high school grades in science, mathematics, social studies, and English; high school graduation rank; and CEEB and SAT scores; and (3) biographical information secured with a 22-item instrument developed for the study. The criterion of final course grade was converted numerically using the scale A=6, R=5, etc.

Data were correlated using a build-up linear multiple regression analysis model. In order to use the regression model to estimate the relative importance of individual learner characteristics, the model was modified by transforming the input variables into standard score form. In addition to analyzing the total samples (A-T, N=315; T-O, N=312) each group was further subdivided into three achievement level subgroups of equal size (high, middle, low) in order to permit the estimation of differences in learner characteristics across ability levels. This subgrouping was carried out on the basis of a first semester predicted grade average developed by the student personnel office. This index was predicted from measures not designed to predict achievement specifically in independent study situations (e.g., high school rank and SAT scores.) All variables were placed in the regression program simultaneously to permit their mutual effects upon each other to be considered. The results were cross-validated on appropriate samples.

RESULTS

It was found that different learner characteristics were significantly related to the criteria in the two courses (See Table 1). The multiple correlations for the A-T sample were: for the total sample, $R=.63$; and for the achievement level subgroups, .48, .56, and .54 (high to low, respectively.)

The multiple correlations for the T-O sample were: total sample, $R=.55$; achievement level subgroups, .37, .46, and .54 (high to low, respectively.) All correlations were judged sufficiently high to permit meaningful interpretation.

In the total samples (not controlled for academic ability), both verbal aptitude (SAT-Verbal) and the restraint scale of the Guilford-Zimmerman Temperament Survey were significantly related to the criterion in both the A-T and T-O courses. Restraint has been interpreted as the tendency to be serious-minded and responsible or the tendency toward introversion. Differences were noted in that prior achievement in mathematical reasoning skills (CEEB-Mathematics) and social studies were more often related to success in the A-T course while prior achievement in mathematics computational skills (mathematics grades) and science achievement (CEEB-Science) were more often related to success in the T-O course.

The most obvious differences noted for the high achievement subgroups were as follows: mathematics reasoning skills and science achievement (high school science grade) were significantly related to success in the A-T course while verbal aptitude, mathematical computational skills, and restraint were significantly related to success in the T-O course. This suggested that learners with high predicted achievement, low verbal aptitude scores, and low restraint scores might learn more effectively under the A-T in which they listen to

repeatable audio-tapes and oral communication is emphasized.

A comparison of the middle achievement subgroups of the A-T and T-O groups revealed that mathematics computational skills, prior science achievement, and restraint were significantly related to success in the T-O course. No intellectual predictors exhibited a significant relationship with success in the A-T course, suggesting that success in the A-T course is not significantly dependent upon prior science and mathematics accomplishments, nor on the tendency to be serious-minded and responsible.

In the low achievement subgroup, little discrimination among A-T and T-O courses was evident on the basis of restraint score or mathematics achievement. As in the case of the high achievement subgroup, verbal aptitude was significantly related to success in the T-O course and achievement in social studies was significantly related to success in the A-T course. Other factors being equal, this suggests that learners whose achievement is predicted to be low and who are high in science achievement (relative to social studies achievement) learn more effectively in the T-O learning environment and vice versa.

An overall consideration of these results revealed the utility of the restraint scale of the GZTS personality survey in its significant correlations with academic success for the total sample and low achievement subgroups in

both the A-T and T-O groups. The restraint scale was significantly correlated with academic success for the high and middle achievement subgroups of the T-O course, but not for the A-T course. This difference suggests that learners classified in high and middle achievement ranges may learn more effectively in the A-T course than the T-O course since performance in the A-T course is uncorrelated with restraint.

In terms of the prediction of academic success, the restraint scale of the GZTS appears to have made a definite contribution to the prediction battery in the presence of the more commonly used intellectual predictors.

The biographical items (education-oriented life history questions and social status index) proved to be of limited utility in this study.

CONCLUSIONS

The results of this study should be interpreted carefully for a number of reasons. The design was correlational rather than experimental in nature; hence no causal inferences should be made. The A-T and T-O courses differed in subject matter (botany vs. zoology) and had different groups of instructors in addition to differing in the instructional method used. Subjects who did not voluntarily complete the data forms or dropped the course were excluded from the sample.

This study, nevertheless, has identified a number of intellectual and personality characteristics which may be useful in predicting achievement levels for individual students in specifiable learning situations. Such predictions could be used to make decisions concerning the best placement of students in alternative learning systems. Presumably some might achieve the most in a traditionally-organized system while others would learn the most in an independent learning system. Secondly, within any system it might be possible to offer instructional alternatives, to predict in which one a student would achieve best, and to make the alternative available to the student. Thirdly, the prediction system identifies personal characteristics of the student in which he is weak or strong. Such information could be used to provide remedial counselling or instruction or to adapt the instruction to fit the strength or weakness.

Of course, all of the potential uses of prediction require much further investigation as does the prediction system itself. With multiple Rs as high as .63 we are accounting for only 40 percent of the criterion achievement variance. Other and better predictors must be found. Hopefully, with better predictors, better control of assessments, and new instructional systems which

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facilitate provision for individual differences, substantial increases in student achievement can be attained.